Autonics



Universal AC/DC Photoelectric Sensors

BEN Series

PRODUCT MANUAL

Be sure to follow the instructions and precautions in the instruction manual, other manuals, and the Autonics website.
The specifications, dimensions, and other information in this document are subject to change without notice for product improvement.
Certain models may be discontinued without notice.

CE UKCA EAC

Safety Precautions

- 'Safety Precautions' are provided to ensure safe and proper use of the product and to prevent accidents or hazards. Please make sure to follow them carefully.
- ⚠ symbol indicates a caution, warning of potential hazards under certain conditions.

⚠ Warning Failure to follow instructions may result in serious injury or death.

01. **Fail-safe device must be installed when using the product in applications that may cause serious injuries or property loss. (E.g. nuclear control systems, medical equipment, ships, vehicles, railroads, aircraft, combustion devices, safety devices, security systems, disaster prevention devices, etc.)**
    Failure to do so may result in personal injury, property loss or fire.
02. **Do not use or store the product in environments containing flammable, explosive, or corrosive gases, or in places exposed to high humidity, direct sunlight, radiant heat, vibration, shock, or salt.**
    Failure to do so may result in explosion or fire.
03. **Do not disassemble, repair, or modify the product without authorization.**
    Failure to do so may result in fire or electric shock.
04. **Do not connect, repair, or inspect the product while connected to a power source.**
    Failure to do so may result in fire or electric shock.
05. **Check the connection diagram before wiring.**
    Failure to do so may result in fire.

⚠ Caution Failure to follow instructions may result in injury or product damage.

01. **Use the product within its rated specifications and performance limits.**
    Failure to do so may result in fire or product damage.
02. **Use a dry cloth to clean the product. Do not use water or organic solvents.**
    Failure to do so may result in fire or electric shock.
03. **Do not use a load over the range of rated relay specification.**
    Failure to do so may result in insulation failure, contact melt, contact failure, relay broken, or fire.

Cautions During Use

- Make sure to follow the instructions in 'Cautions During Use'. Failure to do so may result in unexpected accidents.
- When connecting inductive loads such as DC relays or solenoid valves use a diode, varistor, or similar component to suppress surges.
- Wait at least 0.5 seconds after applying power before using the product. When using separate power supplies for sensor and load, apply power to the sensor first.
- Power input should be supplied from an isolated and limited voltage/current source, or from a Class 2 or SELV power supply.
- To prevent surges and inductive noise, separate the wiring from high-voltage and power lines, and keep wiring lengths as short as possible.
- When supplying power with an SMPS, ground the F.G. terminal and connect a noise suppression capacitor between the 0 V and F.G. terminals.
- When using the product with noise-generating devices (e.g. switching regulators, inverters, servo motors, etc.), make sure to ground the F.G. terminal of the unit.
- This product may be used in the following environmental conditions.
  - Indoors (environment condition rated in 'Specifications')
  - Altitude: up to 2,000 m
  - Pollution Degree 2
  - Installation Category II

Product Components

Sensing type	Through-beam	Retroreflective	Polarized retroreflective	Diffuse reflective
Product components	Product, instruction manual			
Reflector	-	MS-2	MS-2	-
Adjustment screwdriver	× 1	× 1	× 1	× 1
Bracket	× 2	× 1	× 1	× 1
M4 bolt / nut	× 4	× 2	× 2	× 2

Ordering Information

This is only for reference, the actual product does not support all combinations.
For selecting the specified model, follow the Autonics website.

BEN ❶ - ❷ ❸ ❹

❶ Sensing distance
Number: Sensing distance (unit: mm)
Number+M: Sensing distance (unit: m)

❷ Sensing type
T: Through-beam
M: Retroreflective
P: Polarized retroreflective
D: Diffuse reflective

❸ Output method
FR: AC/DC power, relay conctact output
DT: DC power, solid state (transistor) output

❹ Through-beam Emitter/Receiver 01)
No mark: Reflective type
1: Emitter
2: Receiver

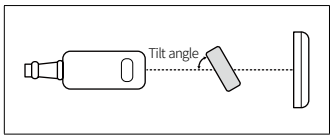
01) This model name is for through-beam photoelectric sensor management only and is not required when placing an order.

Sold Separately

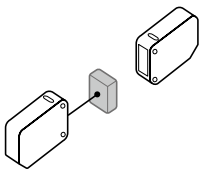
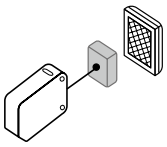
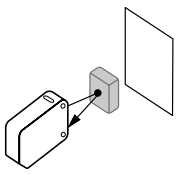
- Reflector: MS Series
- Retroreflective tape: MST Series

Cautions during Installation

- Be sure to install this product by following the usage environment, location, and specified ratings. Consider the listed conditions below.
  - Installation environment and background (reflected light)
  - Sensing distance and sensing target
  - Direction of target's movement
  - Characteristic curves
- When installing multiple sensors closely, it may result in malfunction due to mutual interference.
- Retroreflective: If the sensing target has a glossy surface or high reflection, tilt the sensing target with an angle from 30 to 45 degrees and install the sensor.



- For installation, tighten the screw with a torque of 1.2 N m. Mount the brackets correctly to prevent the twisting of the sensor's optical axis.
- Do not impact with a hard object or bend the cable excessively. That could decrease the product's water resistance.
- Use this product after the test. Check whether the indicator works appropriately for the positions of the detectable object.

Through-beam	Retroreflective	Reflective
		
Emitter - Receiver: Install to face each other	Sensor - Reflector: At least 0.1 m apart, install to face each other (parallel with the sensing side of the unit)	Sensor - Sensing target: Install to face each other (parallel with the sensing side of the unit)

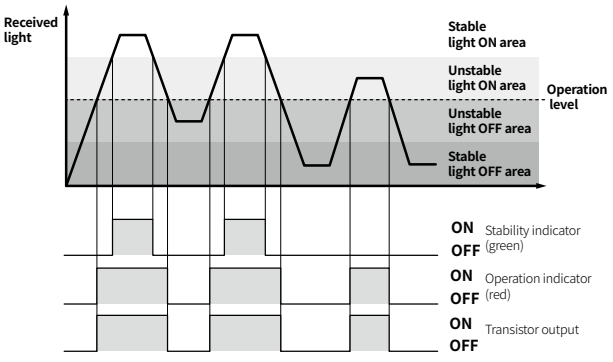
Setting Operation Mode

- Be sure to set the mode before power-on.
- Use the offered adjustment screwdriver. Do NOT turn with excessive force to prevent product damage.

L: Light ON mode	D: Dark ON mode
	

Operation Timing Chart and Indicators

■ Light ON mode

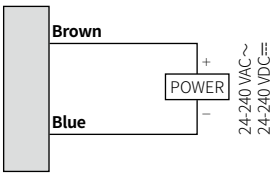


- In Dark ON mode, the waveforms are reversed.

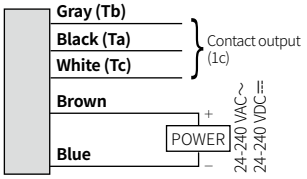
Connections

■ AC/DC power, relay conctact output

- Emitter

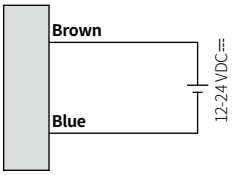


- Receiver, Retroreflective, Polarized retroreflective, Diffuse reflective type

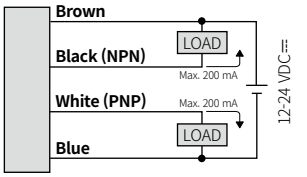


■ DC power, solid state (transistor) output

- Emitter

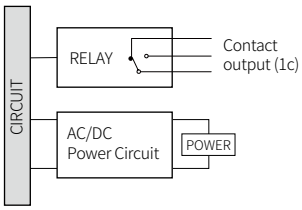


- Receiver, Retroreflective, polarized retroreflective, Diffuse reflective type

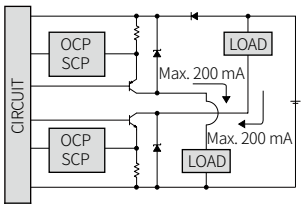


Circuit

■ AC/DC power, relay contact output



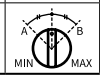
■ DC power, solid state (transistor) output



- OCP (over current protection), SCP (short circuit protection)
- If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the protection circuit.

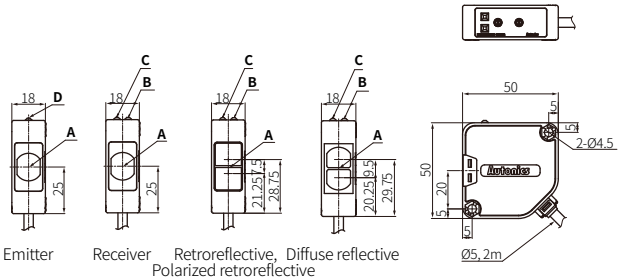
Sensitivity Adjustment

- Set the adjuster for stable Light ON area, minimizing the effect of the installation environment.
- Use the offered adjustment screwdriver. Do NOT turn with excessive force to prevent product damage.
- The steps below are based on Light ON mode.

STEP	Status	Description	
01	Received		Turn the adjuster from MIN to MAX sensitivity and check the position (A) where the operation indicator activates under the light ON area.
02	Interrupted		Turn the adjuster from (A) to MAX and check the position (B) where the operation indicator activates under the light OFF area. If the operation indicator does NOT activate at the MAX (maximum sensitivity): MAX = (B).
03	-		Set the adjuster at the mid position between (A) and (B) for optimal sensitivity.

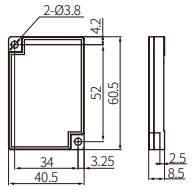
Dimensions

- Unit: mm, For the detailed drawings, follow the Autonics website.

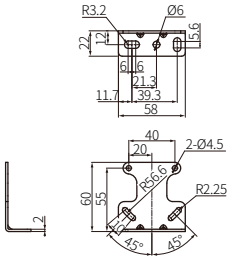


A	Optical axis	C	Stability indicator (green)
B	Operation indicator (red)	D	Power indicator (red)

■ Reflector (MS-2)



■ Bracket



Specifications

Model	BEN10M-T□	BEN5M-M□	BEN3M-P□	BEN300-D□
Sensing type	Through-beam	Retroreflective	Polarized retroreflective	Diffuse reflective
Sensing distance	10 m	0.1 to 5 m [01]	0.1 to 3 m [01]	300 mm [02]
Sensing target	Opaque materials	Opaque materials	Opaque materials	Opaque, translucent materials
Min. sensing target	≥ Ø 16 mm	≥ Ø 60 mm	≥ Ø 60 mm	-
Hysteresis	-	-	-	≤ 20 % of sensing distance
Response time	AC/DC power, relay contace output model: ≤ 20 ms DC power, solid state (transistor) output model: ≤ 1 ms			
Light source	Infrared	Infrared	Red	Infrared
Peak emission wavelength	850 nm	940 nm	660 nm	940 nm
Sensitivity adjustment	-	YES (Adjuster)	YES (Adjuster)	YES (Adjuster)
Operation mode	Light ON mode - Dark ON mode selectable (Adjuster)			
Indicator	Operation indicator (red), stability indicator (green), power indicator (red) [03]			
Certifications	CE UK EAC			
Unit weight (AC/DC power)	≈ 354 g	≈ 208 g	≈ 208 g	≈ 195 g
Unit weight (DC power)	≈ 342 g	≈ 200 g	≈ 200 g	≈ 187 g

01) Reflector (MS-2)
02) Non-glossy white paper 100 × 100 mm
03) Only for the emitter

Output method	AC/DC power, relay conctact output	DC power, solid state (transistor) output
Power supply	24-240 VAC~ ± 10 % 50/60 Hz 24-240 VDC⎓ ± 10 % (ripple P-P: ≤ 10 %)	12-24 VDC⎓ ± 10 % (ripple P-P: ≤ 10 %)
Power / current consumption	≤ 4 VA	It depends on the sensing type
Through-beam	-	Emitter: ≤ 50 mA, receiver: ≤ 50 mA
Reflective	-	≤ 50 mA
Control output	Relay contact output	NPN open collector - PNP open collector simultaneous output
Contact capacity	250 VAC~ 3 A of resistance load, 30 VDC⎓ 3 A of resistance load	-
Conctact composition	1c	
Relay life cycle	Mechanical: ≥ 50,000,000 Electrical: ≥ 100,000	
Load voltage	-	≤ 30 VDC⎓
Load current		≤ 200 mA
Residual voltage		NPN: ≤ 1 VDC⎓, PNP: ≤ 2.5 VDC⎓
Protection circuit	-	Reverse power protection circuit, output short overcurrent protection circuit
Insulation resistance	≥ 20 MΩ (500 VDC⎓ megger)	
Insulation type	Double or strong insulation (dielectric voltage between the measured input and the power : 1 kV)	-
Noise immunity	± 1,000 VDC⎓ the square wave noise (pulse width: 1 μs) by the noise simulator	±240 VDC⎓ the square wave noise (pulse width: 1 μs) by the noise simulator
Dielectric strength	Between the charging part and the case: 1,000 VAC~ 50/60 Hz for 1 min	
Vibration	1.5 mm double amplitude at frequency of 10 to 55 Hz in each X, Y, Z direction for 2 hours	
Vibration (malfunction)	1.5 mm double amplitude at frequency of 10 to 55 Hz in each X, Y, Z direction for 10 min	-
Shock	500 m/s² (≈ 50 G) in each X, Y, Z direction for 3 times	
Shock (malfunction)	100 m/s² (≈ 10 G) in each X, Y, Z direction for 3 times	-
Ambient illuminance (receiver)	Sunlight: ≤ 11,000 lx, incandescent lamp: ≤ 3,000 lx	
Ambient temperature	-20 to 65 °C, storage: -20 to 70 °C (no freezing or condensation)	
Ambient humidity	35 to 85 %RH, storage: 35 to 85 %RH (no freezing or condensation)	
Protection rating	IP50 (IEC standard)	
Connection	Cable type	
Cable spec.	Ø 5 mm, Emitter: 2-wire, AC/DC power: 5-wire, DC power: 4-wire, 2 m	
Wire spec.	AWG22 (0.08 mm, 60-core), insulator outer diameter: Ø 1.25 mm	
Material	Case and case cover: heat resistant ABS, sensing part: PC (polarized retroreflective: PMMA)	

Sold Separately: Reflector MS Series

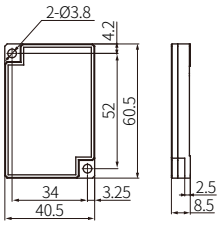
Appearance	Size (W × H)	Reflectance	Sensing type	Model
	40.5 × 60.5 mm	Typical reflectivity	Retroreflective	MS-2
		Typical reflectivity	Polarized retroreflective	MS-2A
		High reflectivity	Polarized retroreflective	MS-2S
	81.5 × 60.5 mm	Typical reflectivity	Retroreflective	MS-3
		High reflectivity	Polarized retroreflective	MS-3S
	29.3 × 38 mm	Typical reflectivity	Retroreflective	MS-4
	15.4 × 24 mm	Typical reflectivity	Retroreflective	MS-5
	13.7 × 23 mm	Typical reflectivity	Retroreflective	MS-6

- Material: PMMA / ABS (front part / rear part)
- Installation: Bolt mounting

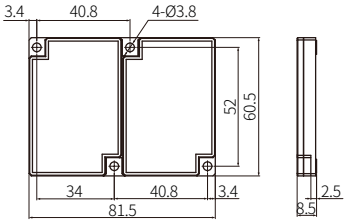
■ Dimensions

(Unit: mm)

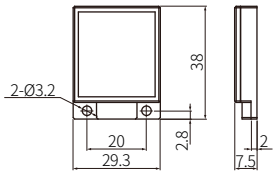
MS-2□



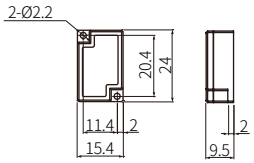
MS-3□



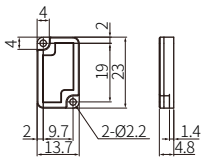
MS-4



MS-5



MS-6



■ Cautions During Installation

- Select a reflector size appropriate for the sensor's operating environment and installation space.
- Generally, a larger reflector provides a longer detection distance.
- Using a high-reflectance reflector increases the detection distance.
- Reflectance may vary depending on the sensor's operating conditions.

Sold Separately: Reflector Tape (MST Series)

Appearance	Size (W × H)	Packaged unit	Sensing type	Model
	50 × 50 mm	10	• Retroreflective • Polarized retroreflective	MST-50-10
	100 × 100 mm	5	• Retroreflective • Polarized retroreflective	MST-100-5
	200 × 200 mm	2	• Retroreflective • Polarized retroreflective	MST-200-2

- Material: PMMA / PC / Acrylic (surface film / prism layer / adhesive layer)
- Ambient temperature: -35 to 65 °C (temperature for adhesion: 10 to 30 °C)
- Installation: Tape cutting (installation distance: ≥ 20 mm)

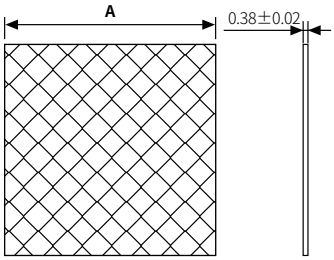
■ Effective Reflectance of MST Series

Series	Sensing type	MST-50-10	MST-100-5	MST-200-2
BTS	Retroreflective	130%	140%	150%
BM		70%	110%	170%
BMS		90%	120%	190%
BEN		90%	130%	140%
BX		90%	100%	110%
BJ/BJR/BJX	Polarized retroreflective	40%	60%	80%
BH		60%	80%	140%
BEN		70%	90%	120%
BX		30%	40%	60%
BRQ		40%	80%	90%
BRQP-B (short body type)		40%	50%	80%
BRQPS (side sensing type)		25%	30%	35%

- The values are relative measurements based on our standard mirrors set to 100%.
- The reflectance may decrease depending on the installation angle (angle of incidence) between the sensor optical axis and the mirror surface.

■ Dimensions

(Unit: mm)



Model	A
MST-50-10	□ 50
MST-100-5	□ 100
MST-200-2	□ 200

■ Cautions During Installation

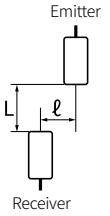
- Select a reflector tape size appropriate for the sensor's operating environment and installation space.
- Generally, a larger reflector tape provides a longer sensing distance.
- Check the reflectance of the reflector tape before use.
- Reflectance may vary depending on the sensor's operating conditions.
- Clean the surface where the reflector tape will be applied with a dry cloth before attachment.
- Avoid creasing or damaging the surface of the reflector tape.
- Clean regularly to maintain optimal performance.
  Use only neutral detergents, and avoid other chemical solvents.

Product Characteristics

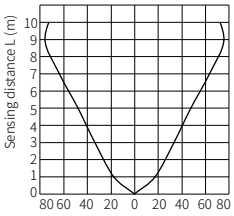
This data is based on internal testing and for reference only. Performance may vary by installation and usage environment. Product testing prior to use is recommended.

Through-beam Type (TYPICAL)

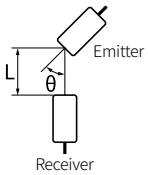
■ Detection Area



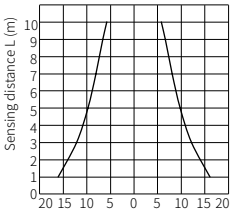
• BEN10M-TDT



■ Emitter Angle

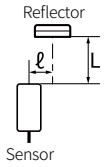


• BEN10M-TDT

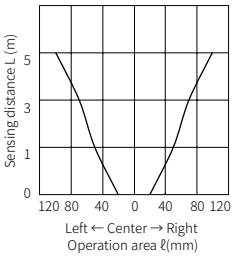


Retroreflective Type (TYPICAL)

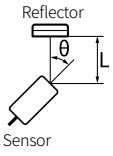
■ Detection Area



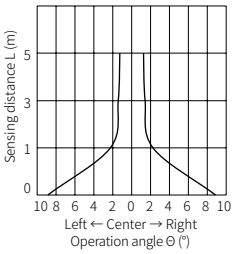
• BEN5M-MDT



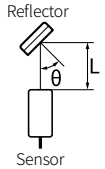
■ Sensor Angle



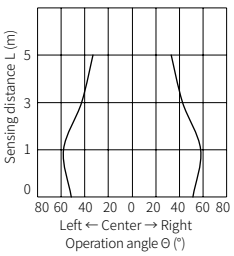
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■ Reflector Angle

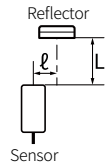


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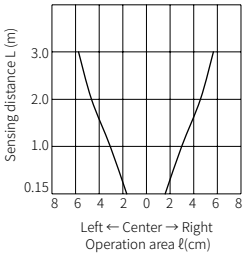


Polarized Retroreflective Type (TYPICAL)

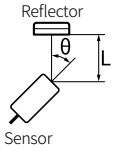
■ Detection Area



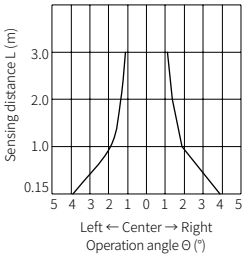
• BEN3M-PDT



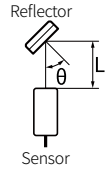
■ Sensor Angle



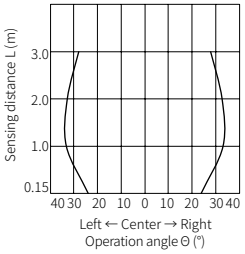
• BEN3M-PDT



■ Reflector Angle

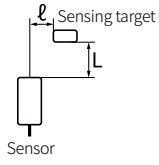


• BEN3M-PDT



Diffuse Reflective Type (TYPICAL)

■ Detection Area



• BEN300-DDT

